Reference Biological Evaluation

Construction of New or Expansion of Existing Residential Overwater Structures and Driving of Moorage Piling

Lake Washington, Lake Sammamish, the Sammamish River and Lake Union, Including the Lake Washington Ship Canal, in the State of Washington

Prepared for:

U.S. Army Corps of Engineers
Seattle District

Prepared by:

Jones & Stokes
Bellevue, Washington

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Section 1. Background and Project History

1.1 Reference Biological Evaluations and Regional General Permits

The U.S. Army Corps of Engineers, Seattle District, Regulatory Branch (Corps) has developed a series of Regional General Permits (RGPs) in Washington State as a means of providing incentives to the public for building structures that are more accommodating for fish. Projects within the parameters of the RGP require significantly less paperwork and time for authorization, relative to standard permitting procedures. If the U.S. Fish and Wildlife Service (USFWS) and NOAA Fisheries both approve the biological evaluation (BE) for this RGP, Endangered Species Act (ESA) consultation procedures will also be pre-approved, speeding the overall application review process.

This RBE has been adapted from the original Biological Evaluation submitted to the USFWS and NOAA Fisheries for RGP-3 (Construction of New or Expansion of Existing Residential Overwater Structures and Driving of Moorage Piling on Lake Washington, Lake Sammamish, the Sammamish River and Lake Union, including the Lake Washington Ship Canal, in the State of Washington). It is intended for use by applicants prior to the approval of the BE by USFWS and NOAA Fisheries.

1.1.1 Corps Review

To use this RBE, an applicant must meet the parameters of the project descriptions (Section 2.2 of this document), the conservation measures (Section 7 of this document), and any additional requirements requested by the USFWS or NOAA Fisheries and agreed to by the Corps or explain in detail the reasons for not meeting all the parameters and conservation measures. The applicant will be required to submit an Application and Reference Biological Evaluation Form and drawings to the Corps so the Corps can confirm that the project meets the criteria for use of the RBE. The Corps will review the proposed application and confirm that the project is close enough to meeting the requirements of the RBE to make the effects analysis appropriate. A proposed Application and RBE form is included in Appendix A of this document.

In the Seattle District, Regulatory Branch of the Corps, there are two primary application reviewers: the project manager and the environmental analyst. The project manager, a generalist in background, oversees the application review process, coordinating with the applicant and state and federal agencies as necessary. The environmental analyst, a technical expert, reviews the permit decisions, jurisdictional determinations, and biological assessments for scientific accuracy and consistency with Corps regulations. With workload designated geographically, the environmental analysts work with project managers as team leaders and review the project managers' assessments and evaluations.The Corps project manager and environmental analyst will review the activity and SPIF to determine if the project meets the criteria for of the RBE, and if the activity may be submitted for consultation using the RBE. The project manager will review the conservation measures for each activity as outlined in the RBE. The environmental analyst will approve the project manager's review.

1.2 Discussion of Past Relevant Consultations

Table 1-1 shows the number of Department of the Army permits by activity finalized for the years 1997 through 2002, and from January 1, 2003 through May 13, 2003. The table does not distinguish between new structures and repair or maintenance of existing structures.

Table 1-1: History of Permitting Activity by Area

Activity	1997	1998	1999	2000	2001	2002	2003	Total
Piers – Lake Washington	39	53	18	9	66	49	15	249
Piers – Lake Sammamish	15	17	3	1	5	13	2	56
Piers – Sammamish River	1	0	0	0	1	0	0	2
Piers – Lake Union	2	1	0	0	1	2	0	6
Piers – Lake Washington Ship Canal	1	1	0	0	0	0	0	2

Section 2. Description of the Action

2.1 Project Purpose and Need

The purpose of this RBE is to expedite the authorization of recurring activities that are similar in nature and have minor individual and cumulative adverse impact on the aquatic environment. This RBE would minimize the amount of paperwork and time required to authorize qualifying projects by making available for public use a Department of the Army general permit that is at the Services awaiting concurrence. This permit will include a completed ESA Section 7 consultation, Essential Fish Habitat consultation, state water quality certification, and coastal zone management consistency concurrence.

2.2 Project Description

This RBE analyzes the impacts of the following activities in Lake Washington, Lake Sammamish, the Sammamish River, and Lake Union, including the Lake Washington Ship Canal:

- Construction of a new residential overwater structure, or expansion of an existing residential overwater structure
- Driving of moorage piling
- Removal of an existing residential overwater structure
- Future maintenance
- Beach nourishment

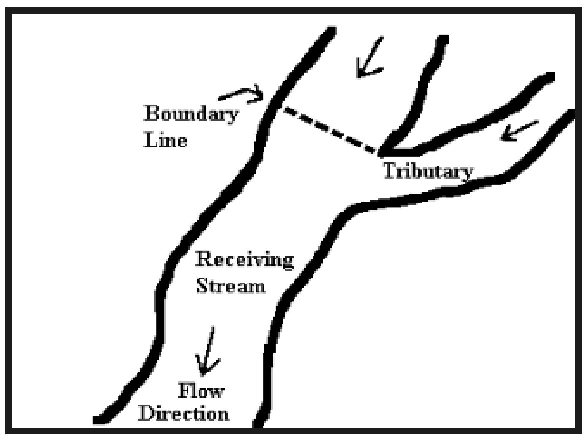
Residential overwater structures may include the following combination: (a) pier, ramp, and float; (b) ramp and pier; (c) ramp and float; or (d) float. A repaired or modified structure may be different in kind from the existing structure. For example, an existing float may be modified to a pier, ramp, and float. This permit will authorize the installation, replacement, repair, or modification of one overwater structure per upland residential waterfront property owner, <u>or</u> one joint-use overwater structure for two or more adjacent waterfront property owners. Each activity must comply with the conservation measures listed in Section 7 of this document.

The impacts to be analyzed by this RBE are limited to impacts from the construction of new or expansion of existing residential overwater structures including piers, floats, ramps, and other similar structures and driving of moorage piling. The RBE also analyzes impacts from the placement of fill material for the purpose of beach nourishment and/or fish habitat enhancement, as required by the Hydraulic Project Approval (HPA) issued by the Washington Department of Fish and Wildlife (WDFW).

2.3 Action Area

The action area includes all areas that could be affected by the proposed project and is not limited to the actual project site. The overall scope or action area of the RBE is Lake Washington, Lake Sammamish, the Sammamish River and Lake Union, including the Lake Washington Ship Canal. The action area does not include any tributaries of these waterbodies. Figure 1 below shows the demarcation between the lake or river and the tributaries.

Figure 1. Demarcation Between the Lake or River and Tributaries



The project specific action area includes the project site, with a radius of

- 1,000 feet around the proposed activity for chinook salmon and bull trout, and
- 1 mile from the project site for bald eagles.

These areas are based on the type of construction activities proposed and the limits of potential project effects as discussed in Section 5 of this document.

2.4 Discussion of Interdependent and Interrelated Actions

No interdependent or interrelated actions will be associated with the permitted activities within the RBE. All permitted activities will be single and complete actions.

2.5 Maps of the Project Area and Action Area

The project and action area for activities that would be covered under this RBE are shown in Figure 2.

Insert Figure 2. Project and Action Area for Activities Covered Under the Proposed RGP-3.

Section 3. Status of the Species and Critical Habitat

3.1 Species To Be Covered

Table 3-1 indicates the federally listed species covered under this BE that may occur or are likely to occur in the Lake Washington, Lake Union, Lake Sammamish, or Sammamish River action areas. The table also shows the status of designated critical habitat, the effects determination for the projects covered under this BE, and a brief justification for the effects determinations.

3.2 Description of Species

3.2.1 Puget Sound Chinook Salmon (*Oncorhynchus tshawytscha*) ESU

The Puget Sound evolutionarily significant unit (ESU) of chinook salmon was listed as threatened on March 24, 1999 (64 FR 14307). It includes all naturally spawned populations of chinook salmon from rivers and streams flowing into Puget Sound including the Strait of Juan De Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound, and the Strait of Georgia in Washington.

NOAA Fisheries has received petitions to de-list the Puget Sound ESU. In a recent U.S. District Court ruling, the Court found NOAA Fisheries' prior treatment of hatchery fish in ESA listing determinations to be arbitrary and capricious. As such, on February 11, 2002 NOAA Fisheries found that the petitions presented substantial scientific and commercial information indicating that the petitioned actions may be warranted (67 FR 6215). NOAA Fisheries, therefore, is currently reviewing all available information on the status of the Puget Sound ESU. The status update, however, will not be completed until after a revision of agency policy regarding the consideration of hatchery fish in ESA status reviews of Pacific salmonids.

A recovery plan for chinook salmon has not been completed.

Table 3-1. Summary of Findings by Species

Listed Species or Critical Habitat Unit	Designated Critical Habitat	Effects Determination	Justification
Chinook salmon (*Oncorhynchus tshawytscha*) Puget Sound ESU (Threatened)	Withdrawn April 30, 2002. Currently under development.	May Affect, Not Likely to Adversely Affect.	The actions proposed for coverage under this RBE are expected to improve or maintain the baseline conditions related to littoral productivity, the shoreline environment, and potential salmonid predator habitat through structure design criteria, riparian planting requirements, and removal of existing structures. The actions proposed for coverage under the RBE are not expected to harm or otherwise result in take of chinook salmon.
Bull trout (*Salvelinus confluentus*) Puget Sound/Coastal DPS (Threatened)	None Designated.	May Affect, Not Likely to Adversely Affect.	The actions proposed for coverage under this RBEare expected to improve or maintain the baseline conditions related to littoral productivity, the shoreline environment, and potential salmonid predator habitat through structure design criteria, riparian planting requirements, and removal of existing structures. The actions proposed for coverage under the RBE are not expected to harm or otherwise result in take of bull trout.
Bald eagle (*Haliaeetus leucocephalus*) (Threatened)	None Designated.	May Affect, Not Likely to Adversely Affect.	The actions proposed for coverage under this RBE will not impact potential shoreline habitats that may be utilized by bald eagles for perching or foraging. Foraging may be affected due to expected increases in recreational boat use associated with new residential overwater structures and driving of moorage pilings. Conservation measures and the implementation of construction timing windows near known nesting sites would minimize or avoid potential effects to bald eagles within the action area. No trees will be removed that could afford potential perching or foraging habitat for bald eagles.
Marbled Murrelet	Designated May 24, 1997.	No Effect.	Marbled murrelets do not occur in the action area. Marbled murrelets may occur in marine waters (Shilshole Bay, Elliott Bay, Puget Sound) adjacent to the action area but do not forage within the action area of this BE.

3.2.1.1 Biological Requirements

Adult chinook salmon migrate into freshwater streams to spawn, moving up into their natal streams to spawn in September and October. Chinook salmon require clean, cool water and clean gravel for spawning. Eggs are deposited and buried in gravel nests where they incubate. Eggs reside in the gravels until hatching in 90 to 150 days, depending on water temperature. After hatching, fry rear in their natal streams for up to 5 months. Rearing occurs from February through June. The best rearing habitat is generally associated with pools and wetland areas where woody debris and overhanging vegetation can provide cover and protection.

The young fish begin their migration to salt water in March through July, with peak migration occurring in June. The salmon then mature in marine waters until between 2 and 6 years old, when they return to their home system to spawn. The average age of chinook spawners is 4 years (Myers et al. 1998).

3.2.1.2 Designated Critical Habitat

Critical habitat was originally designated on February 16, 2000 (65 FR 7764) for the Puget Sound chinook salmon ESU. On April 30, 2002 the U.S. District Court for the District of Columbia approved a NOAA Fisheries consent decree withdrawing the critical habitat designation for this ESU.

Critical habitat for this ESU is currently under development according to the NOAA Fisheries web site (April 16, 2003), and it is likely that NOAA Fisheries will propose new critical habitat designations for this species in the future.

Because the action areas are accessible to Puget Sound chinook salmon, project sites within the action areas will likely be considered critical habitat for this ESU if such habitat is designated in the future.

3.2.1.3 Factors of Decline

Total abundance in the Puget Sound ESU is relatively high; however, much of this production is hatchery-derived. Both long- and short-term trends in abundance are predominantly downward, and several populations are exhibiting severe short-term declines (WDF et al. 1993). Spring-run chinook salmon populations in this ESU are all depressed. Moreover, the relatively high abundance of hatchery fish may be masking a declining trend in abundance of wild fish. In many areas, spawning and rearing habitats have been severely degraded and migratory access restricted or eliminated. Thus, this ESU is likely to become endangered in the foreseeable future (Myers et al. 1998).

Two recent studies have attempted to classify chinook populations within the area of the Puget Sound ESU. The widely used SASSI study (WDF et al. 1993) found 26 stocks of chinook salmon in Puget Sound. At the time of their report, the authors classified the population status of approximately half of the stocks as depressed. However, since that time, there has been a sharp decline in the abundance of Puget Sound chinook, and nearly all naturally reproducing populations in the area are now considered depressed (Myers et al. 1998).

Habitat within the boundaries of the Puget Sound ESU has been blocked or degraded. In general, upper tributaries have been impacted by forest practices, and lower tributaries and mainstem rivers have been impacted by agriculture and/or urban development. Diking for flood control, draining and filling of freshwater and estuarine wetlands, and sedimentation due to forest practices and urban development are cited as problems throughout the Puget Sound region (Myers et al. 1998).

3.2.2 Coastal/Puget Sound Bull Trout *(Salvelinus confluentus)* DPS

The Puget Sound distinct population segment (DPS) bull trout was listed by the USFWS as threatened under the ESA on November 1, 1999 (64 FR 58910). All naturally spawning populations of bull trout in the continental United States are included in the listing. On January 9, 2001 (66 FR 1628), Washington stocks of Dolly Varden were also listed as threatened because of their similarity in appearance to bull trout.

3.2.2.1 Biological Requirements

Bull trout exhibit resident and migratory life history strategies through much of their current range (Rieman and McIntyre 1993). Resident bull trout complete their life cycles in the tributary streams in which they spawn and rear. They are strongly influenced by water temperature and are seldom found in streams exceeding summer temperatures of 18°C. Bull trout eggs require very cold incubation temperatures for normal embryonic development, and cold water temperatures may result in higher egg survival rates and faster growth rates in fry (Pratt 1992).

All life history stages of native char are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools. Spawning typically occurs in late summer and early fall in low gradient streams with loose, clean gravel and water temperatures between 5 and 9°C (WDFW 2000). Many spawning areas are associated with cold water springs or areas where stream flow is influenced by groundwater (USFWS 1997a). Overwintering habitat varies with life history form but always requires cool, clean water with insects, macro-zooplankton, and small fish for larger adults (WDFW 2000).

Bull trout are opportunistic feeders with food habits related primarily to their life history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macro-zooplankton, amphipods, mysids, crayfish, and small fish. Subadult bull trout rapidly convert to eating fish, feeding indiscriminately on other fish species in the area (WDFW 2000).

3.2.2.2 Designated Critical Habitat

Critical habitat for bull trout of the Coastal/Puget Sound DPS has not been proposed or designated.

3.2.2.3 Factors of Decline

Some factors that have likely contributed to the decline of bull trout in the Lake Washington basin include:

- Modifications of hydrology and stream flow
- Degraded water quality, elevated water temperatures, nutrients, and chemical contamination
- Loss of channel complexity and floodplain connectivity
- Increase sedimentation and altered sediment transport processes
- Degraded riparian conditions
- Fish passage barriers

Little is known regarding the historic abundance of bull trout in the Lake Washington basin, but it is likely that bull trout were prevalent historically. Today, the only potentially viable bull trout subpopulation in the Lake Washington watershed is the Chester Morse Reservoir subpopulation. Bull trout spawning has not been confirmed within the Sammamish River-Issaquah Creek subpopulation, and only two bull trout have been observed in the system within the last 10 years.

The thermal requirements of bull trout for spawning and successful egg incubation are being met in few streams in the Lake Washington basin, and may prevent reproduction in much of the Lake Washington system. Only a few streams approach the winter snow line, above which bull trout spawning is more likely to occur, and may be too small to be utilized by migratory bull trout for spawning.

The Chester Morse Reservoir subpopulation is above an anadromous barrier and is a glacial relic population. The population exhibits an adfluvial life history strategy, although resident bull trout may exist in the upper watershed. Because all life history strategies can arise from the same population, it is possible that some bull trout emigrate from the Chester Morse Reservoir to exhibit anadromy or to reside in Lake Washington. Water temperatures in the lower Cedar River are probably too high to support a fluvial population. Cedar River tributaries below Chester Morse Reservoir likely do not meet the thermal requirements for spawning and successful egg incubation; thus, bull trout that emigrate from Chester Morse Reservoir would not represent a viable spawning population. However, these fish may spawn in a non-natal system. Char are known to exhibit “pioneering” behavior, spawning in areas other than their natal stream. Anadromous bull trout and Dolly Varden overwinter in fresh water and may overwinter in systems other than their natal system (City of Bellevue 2003).

3.2.2.4 Population Trends of the Species

The population trend for bull trout of the Lake Washington basin is presumed to be declining. Certainly the population has declined since settlement of the basin began in the late 1800s, but it is unclear if the trend continues today, or if those remnant populations that exist within the basin today are being maintained or continuing to decline.

3.2.3 Bald Eagle *(Haliaeetus leucocephalus)*

The bald eagle was designated as threatened on March 11, 1967. It was listed as endangered when the ESA was enacted in 1973, and was downlisted to threatened status in the coterminous United States in 1995. On July 6, 1999 the USFWS proposed to de-list the bald eagle in the lower 48 states (64 FR 36453).

The bald eagle is listed as threatened by both the USFWS and WDFW. Recovery efforts over the last 25 years, including habitat protection, development and implementation of the Pacific Bald Eagle Recovery Plan (USFWS 1986), and the banning of dichloro-diphenyl-trichloroethane (DDT) and other organochlorine pesticides, have led to increases in both the number and range of bald eagle populations. The species breeds across much of Canada, the Pacific Northwest, throughout the Great Lakes states, and along the Eastern and Gulf Coasts. Washington hosts one of the largest populations of wintering bald eagles in the lower 48 states as well as one of the largest populations of nesting pairs. The majority of nesting bald eagles in Washington occur west of the Cascade Mountains (Smith et al. 1997).

Early declines in bald eagle populations in Washington and nationwide were attributed to human persecution and destruction of riparian, wetland, and conifer forest habitats, as well as reductions in prey sources. However, the widespread use of organochlorine pesticides that caused eggshell thinning and subsequent reproductive failure was the most important factor in the decline of the species (Detrich 1985).

3.2.3.1 Biological Requirements

Within Washington, 99 percent of all bald eagle nest sites are located within 1 mile of a lake, river, or marine shoreline, with an average distance from a waterbody of 635 feet. Nests tend to be closer to rivers and marine shores than to lakeshores, which may be attributed to the heavy development that occurs along lakeshores, as opposed to marine and river shorelines (Stinson et al. 2001).

Bald eagles typically nest in stands of mature trees. Nests are often constructed in the largest tree in a stand with an open view of the surrounding environment. Snags and dead-topped live trees may be important in providing perch and roost sites within eagle territories. Because of their large size, eagles require ready access to an abundant supply of medium sized to large fish during breeding (Johnsgard 1990). Freedom from human disturbance is probably another important component of suitable nesting habitat (Rodrick and Milner 1991).

The density of nesting bald eagles is dependent on prey populations, human disturbance, and availability of nest and perch trees. In areas of high quality habitat, nest sites may be spaced every few miles. In Clallam and San Juan Counties, active bald eagle nest sites averaged one every 4 to 5.6 miles. In southeast Alaska, active nest sites averaged one every 1.25 to 2.5 miles (Stinson et al. 2001).

Perching trees typically offer a commanding view of a foraging area. Nesting bald eagles exhibit consistent daily foraging patterns, using the same perches. Foraging perches must be strong enough to support a bald eagle and offer some isolation from human activity. Wintering bald eagles may show a preference for deciduous trees when the trees are defoliated, which allows greater visibility of the surrounding area (Stinson et al. 2001).

Bald eagles have extensive winter ranges. Winter ranges of 15 eagles captured along the Skagit River averaged 17,450 square miles, ranging from 89 to 113,365 square miles over 24 winters of observation. Some eagles migrated quickly to a distinct area and remained in a relatively small range, while others migrated to new locations throughout the winter (Stinson et al. 2001).

Bald eagles winter along rivers, lakes, and reservoirs that support adequate fish or waterfowl and have mature trees or large snags available for perch sites. Bald eagles often roost communally during the winter, typically in a stand of mature trees with an open branching structure and well-developed canopies. Winter roost areas are usually isolated from human disturbance (Johnsgard 1990).

It has been suggested that bald eagles acclimate to disturbances. A small but apparently growing number of bald eagles in Washington are exhibiting an unexpected tolerance to human presence and activities, and they are nesting successfully in close proximity to homes. This may be indicative of a local shortage of nesting habitat. Eagles show a strong year-to-year fidelity to a nest territory and are reluctant to abandon a territory despite increased disturbance and habitat alteration, which may increase when the population is at carrying capacity and no vacant suitable nest sites are available (Stinson et al. 2001).

3.2.3.2 Designated Critical Habitat

The USFWS has not designated critical habitat for the bald eagle (USFWS 1986).

3.2.3.3 Factors of Decline

Bald eagles were typically very widespread in North American, breeding in nearly all of the conterminous states, in addition to Canada and Alaska. The first major decline in bald eagle populations began in the mid- to late 1800s when widespread shooting for feathers and trophies led to extirpation of eagles in some areas (Federal Register July 6, 1999). Many eagles were trapped or poisoned by ranchers and by federal animal damage control agents attempting to control livestock predators. Egg collectors decimated nest sites in some areas (Stinson et al. 2001). Hunting and fishing reduced some of the bald eagles' prey base, and forest clearing and shore development resulted in a substantial loss of nesting and foraging habitat into the 1940s (Federal Register July 6, 1999).

In the late 1940s, organochlorine compounds (including DDT) began to be used to control mosquitoes along coastal and wetland areas and as a general crop insecticide. Shortly thereafter, the reproductive success of bald eagles plummeted. Only in the 1970s was it determined that dichlorophenyl-dichloroethylene (DDE), the principal breakdown product of DDT, was accumulating in the fatty tissues of adult female bald eagles, impairing their ability to release the calcium necessary for eggshell formation. Thin eggshells led to reproductive failure and a steady decline in the population until the early 1970s when the EPA banned the use of DDT (Federal Register July 6, 1999).

The reasons for the decline of bald eagles in Washington mimic the nationwide factors described above. Although DDT was banned in 1972, studies completed in two regional populations along the lower Columbia River and Hood Canal found significant concentrations of DDE and/or PCBs in eggs of bald eagles. The continuing presence of these substances may contribute to low reproductive success (Anthony et al. 1993, Mahaffy et al. 2001).

Although eagles are protected under the ESA, Migratory Bird Treaty Act, Bald and Golden Eagle Protection Act, as well as a variety of Washington State laws, illegal hunting and black market trading may still continue (Stinson et al. 2001).

Large trees that provide nesting habitat for bald eagles are a diminishing resource in Washington State, particularly near shorelines where waterfront property continues to be a valued commodity in the residential development market. Almost 80 percent of Washington's shoreline is privately owned. Despite restrictions on clearing of habitat imposed by Washington's Shoreline Management Act, the loss of large trees used for nesting, perching, and roosting has been, and will continue to be, a limiting factor for breeding and wintering populations of bald eagles within the state (Stinson et al. 2001).

Finally, changes in water quality and habitat conditions have impacted prey populations, including historical salmon runs and aggregations of waterfowl in and around Puget Sound and the Columbia River (Stinson et al. 2001).

3.2.3.4 Population Trends of the Species

To facilitate the recovery of the bald eagles in the lower 48 states, five recovery regions were established, beginning in 1982. All of Washington State lies within the Pacific Recovery Region. Federal de-listing goals for this region include a minimum of 800 nesting pairs with an average reproductive rate of 1.0 fledged young per occupied breeding area, and an average success rate for occupied breeding areas of not less than 65 percent over a 5-year period. Attainment of breeding population goals should be met in at least 80 percent of the 37 management zones, and wintering populations should be stable or increasing (Federal Register July 6, 1999).

Since 1995, many of these goals have been reached. Productivity has averaged about 1.0 young per occupied breeding area since 1990, and the average success rate for occupied breeding areas has exceeded 65 percent for the past 5 years (Federal Register July 6, 1999). However, although the number of occupied breeding areas continues to increase, only 28 of the 37 management zones have met breeding population goals (76 percent). Of the 28 zones where target levels have been met, at least 11 have more than doubled the established goal (Federal Register July 6, 1999).

The last statewide surveys conducted in 1988 at 841 known territories recorded 664 occupied sites. Between 1981 and 1998, the nesting population in Washington had increased 427 percent, or about 10 percent annually. However, although no comprehensive surveys have been completed since 1998, a recent decline in nest occupancy rate and the appearance of nests in developed areas suggests that nesting habitat in parts of western Washington may be approaching saturation. Similarly, between 1990 and 1998, there have been no trends in productivity or nest rate success, indicating that such variables have stabilized and that the nesting eagle population may be near carrying capacity (Stinson et al. 2001).

Despite these upward trends, increases in human populations will likely bring about habitat changes that will limit space available for foraging and nesting, as well as the abundance of required prey populations.

3.2.4 Marbled Murrelet (*Brachyramphus marmoratus*)

The marbled murrelet was listed as threatened by the USFWS in 1992 (USDI 1996). The North American subspecies of marbled murrelet occurs from the Aleutian Islands south along the coasts of Alaska, Washington, Oregon, and California. Its distribution is closely correlated with the presence of late-successional coastal forests (Carter and Erickson 1988, Nelson 1989, Paton and Ralph 1988).

When at sea, marbled murrelets are primarily found within 1 mile of shore (Strachan et al. 1995, Strong et al. 1996). In Washington, the marbled murrelet is found in all nearshore marine environments, with the greatest concentrations found in the northern Puget Sound area (WDFW 1993).

3.2.4.1 Biological Requirements

Murrelets live primarily in a marine environment but fly inland during the nesting season to nest in older forests. Murrelets typically nest in low elevation old-growth and mature coniferous forests (Hamer 1995, Hamer and Cummins 1991). Once at sea, murrelets can be found as dispersed pairs or in flocks or aggregates (Strachan et al. 1995, Strong et al. 1996). Strong et al. (1996) found that most murrelets occurred within 1 mile of the shoreline, regardless of their age. However, hatch-year fledglings were closer to shore than the general population.

Marbled murrelets construct their nests high in older conifers with wide horizontal limbs. In Washington State, murrelets have been detected up to 50 miles inland from the coast, most typically adjacent to major drainages (Hamer and Cummins 1991). However, more than 90 percent of all observations have occurred within 37 miles of the coast in the northern Washington Cascades (61 FR 26256-26320).

Although marbled murrelets have been known to nest in stands as small as 7.5 acres, the average nest stand size in Washington is 515 acres (Hamer and Nelson 1995) and large contiguous stands of suitable habitat are considered important to marbled murrelet recovery (61 FR 26256-26320). Marbled murrelet nests in Washington are usually found at elevations below 3,500 feet, within 40 miles of the nearest body of salt water (Hamer 1995), and in stands with old-growth characteristics (Raphael et al. 1995).

Potential habitat for the marbled murrelet is defined in survey protocol as mature, old-growth, or younger coniferous forests that have deformations or other structures suitable for nesting (Ralph et al. 1991). Although this definition is general, it encompasses recent information on murrelet nesting, including documented activity in younger forests (40 to 80 years) in the Oregon Coast Range (Grenier and Nelson 1995). Nonetheless, nearly all marbled murrelet nest trees have been located in old-growth and mature stands or stands with old-growth characteristics (Hamer and Nelson 1995). The percentage of old-growth tree crown cover appears to be an important factor associated with occupied sites (Miller and Ralph 1995, Hamer and Nelson 1995).

Because so few marbled murrelet nests have been found, understanding of the microhabitat requirements of the bird is limited. The few nests that have been measured suggest that the number of potential nest sites on trees may be the best predictor of stand occupancy by this species (Hamer and Nelson 1995). Murrelets require a broad flat surface (referred to as a platform) on a large lateral limb or other lateral structure. Large lateral limbs are usually found on trees with larger diameters and/or on older trees. Potential nest platforms include mistletoe blooms, deformed limbs, and areas where a tree has been damaged (Hamer and Nelson 1995). The essential element of a murrelet nest site, therefore, is the presence of a horizontal limb that is sufficiently large, wide, and flat to support a nest.

3.2.4.2 Designated Critical Habitat

Critical habitat for the marbled murrelet was designated by the USFWS in 1997 (61 FR 26256). No designated critical habitat units occur within the action area. The following biological and physical features determine designation of critical habitat for marbled murrelet: space for growth and normal behavior; nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, rearing of offspring; and habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.

3.2.4.3 Factors of Decline

The primary factor contributing to the decline in populations of marbled murrelets is the loss and alteration of late-successional coniferous forests, the species' primary nesting habitat, through commercial timber harvest. Additional factors potentially contributing to population declines include reduced food availability (Burkett 1995) from human over-harvesting of fish (Ainley et al. 1995), direct mortality associated with gill-net fishing, predation, urbanization, and the effects of oil spills (Fry 1995, Carter and Kuletz 1995, WDFW 1993).

3.2.4.4 Population Trends of Species

As part of the Marbled Murrelet Recovery Plan (USFWS 1997b), a demographic model was developed to help better understand marbled murrelet population dynamics (Beissinger and Nur in Appendix B, USFWS 1997b). The demographic model predicted that murrelet populations are likely to be declining at an estimated rate that varied from 1 to 14 percent per year, depending on the parameter estimates used. The authors estimated that the most likely rate of decline would be around 4 to 7 percent per pear.

Predicting or estimating population trends for marbled murrelets is difficult because their population dynamics and demography have not been well described. Ralph et al. (1995) summarized some of the reasons for the variability in population estimates among researchers, including differences in methodology, assumptions, spatial coverage, and survey and model errors. Nevertheless, both Ralph et al. (1995) and the Marbled Murrelet Recovery Team (USFWS 1997b) have concluded that the listed population appears to be in a long-term downward trend.

Section 4. Environmental Baseline

The environmental baseline represents the current base set of conditions to which the effects of the proposed action would be added. The environmental baseline (50 CFR Part 402.02) consists of

- the past and present effects of all federal, state, or private actions and other human activities in the action area;
- the anticipated impact of all proposed federal projects in the action area that have already undergone formal or early ESA Section 7 consultation; and
- the impact of state or private actions that are contemporaneous with the consultation in process.

The action area for Lake Washington, Lake Sammamish, Sammamish River, and Lake Union, including the Lake Washington Ship Canal, was previous described in Section 2.3 of this document. The discussion below describes the environmental baseline conditions within the action area of the activities covered under the RBE.

4.1 Description of the Environmental Baseline

The discussion below was derived primarily from the Limiting Factors Report for Water Resource Inventory Area (WRIA) 08, the Cedar-Sammamish basin, published by the Washington Conservation Commission (Kerwin 2001). Additional sources are cited in the text.

4.1.1 Lake Washington

Lake Washington is the second largest natural lake in Washington State with a surface area of 34.59 square miles (22,138 acres). It is approximately 20 miles long with a mean width of 1.5 miles and over 50 miles of shoreline. The maximum depth of the lake is 214 feet, with a mean depth of 108 feet.

Lake Washington drains to Puget Sound via the Ship Canal and the Hiram Chittenden Locks (also called the Ballard Locks). The primary inflow to the system is the Cedar River, which contributes approximately 55 percent of the mean annual inflow. The Sammamish River contributes approximately 27 percent of the surface flow to Lake Washington. Numerous other small streams, including Thornton Creek, Juanita Creek, Kelsey Creek, Lyon Creek, and May Creek, also drain into the lake.

Lake Washington has been significantly affected by human activity. In 1916 the natural outlet for the lake was changed from the Black River to the Ballard Locks as Lake Washington and Lake Union were connected, and the Cedar River was redirected into Lake Washington to increase inflow. This action lowered the level of Lake Washington by approximately 10 feet, exposed 2.1 square miles (1,344 acres) of previously shallow water habitat, reduced the surface area of the lake by 7 percent, decreased the length of the shoreline by approximately 13 percent, and eliminated much of the lake's wetlands. Today the lake level is controlled by the release of water at the Ballard Locks and is not allowed to fluctuate more than 2 feet, while historically the lake level fluctuated by as much as 6.5 feet during flood events.

The shoreline of Lake Washington has been significantly altered. Historically, more commercial development was located on the lakeshore. Over time, as the population in the watershed has increased, the demand for residential waterfront property increased significantly. Today the majority of the shoreline is urban and residential, with the exception of some commercial and industrial developments. Thirteen incorporated cities now border the lake.

Development within the Lake Washington watershed has led to dredging and filling of shoreline areas, and construction of bulkheads, piers, ramps, and floats along the shoreline. Bulkheads occur along approximately 82 percent of the shoreline of the lake. An estimated 2,700 piers and floats occur along the shoreline of the lake, covering approximately 4 percent of the lake's surface within 100 feet of shore. Bridges, marinas, moored vessels, and commercial developments create additional overwater surface area that the 4 percent does not reflect.

Unretained shorelines include beaches, natural vegetation, and human-altered landscapes. Such shorelines exist along 24.0 percent to 32.4 percent of the northern Lake Washington shoreline and 6.0 percent to 41.0 percent of the southern Lake Washington shoreline (lower values are from Parametrix and NRC 1999; higher values from Toft 2001). Differences in the percentage of the unretained shoreline could be due to differences in measurement methodology and the level of the lake at the time of the survey (Toft 2001).

As of the year 2000, a total of 2,737 docks existed along the Lake Washington shoreline, with an overall frequency of 36 docks per mile (Toft 2001). Four percent of these structures are large marina docks and the remaining 96 percent are residential/recreational structures.

The majority (99 percent) of all the docks are less than 2 meters high and 7 percent of these docks have a building attached to them. Only 1 percent of the docks are higher than 2 meters and most of these docks also have an attached building (Toft 2001).

Much of the large woody debris (LWD) that was probably associated with the lake's shoreline in the past has been eliminated. The only "natural" shoreline remaining along the lake, where recruitment and retention of LWD is likely to occur, is in the area of St. Edwards Park, which represents less than 5 percent of the lake's shoreline. A recent survey of the 33.2 miles of shoreline under the jurisdiction of the City of Seattle (which accounts for approximately 66 percent of the lake shore) indicated that "natural vegetation" occurred along 22 percent of the northern shoreline and 11 percent of the southern shoreline.

4.1.2 Lake Sammamish

The Lake Sammamish watershed covers approximately 86.1 square miles (55,104 acres). Lake Sammamish is approximately 8 miles long and 1.25 miles wide with a surface area of

7.64 square miles (4,892 acres), a maximum depth of 105 feet, and a mean depth of 58 feet. Issaquah Creek is the major tributary to Lake Sammamish, contributing approximately 70 percent of the surface flow. Surface water discharges from Lake Sammamish through the Sammamish River at the north end of the lake.

The majority of the shoreline of Lake Sammamish is privately owned except a few public parks, including King County's Marymoor Park at the north end of the lake, the City of Redmond's Idylwood Park on the northwest end of the lake, and Sammamish State Park on the south end of the lake.

Lake Sammamish is designated as a "resource of statewide significance" under the Shoreline Management Act. It provides migratory and rearing habitat for several salmonids including chinook salmon and bull trout and nesting and foraging habitat for bald eagles.

4.1.3 Sammamish River

The Sammamish River conveys flows from Lake Sammamish to the north end of Lake Washington, providing drainage for approximately 240 square miles (153,600 acres). Of this area, 97 square miles (62,080 acres) are in the Lake Sammamish basin; 50 square miles (32,000 acres) are in the Bear Creek basin; and 67 square miles (42,880 acres) are in the Little Bear, Swamp, and North Creek basins, with 26 square miles (16,640 acres) remaining in the area. The Sammamish River is 13.8 miles in length (Williams et al. 1975), with an annual mean discharge of 312 cubic feet per second (cfs) between 1965 and 2000 (USGS 2003).

Prior to development, the Sammamish River had a complex, highly sinuous, meandering channel and abundant wetlands that were filled with peat and diatomaceous earth. Prior to the construction of the Lake Washington Ship Canal there was an elevation difference of approximately 8.4 feet between Lake Sammamish and Lake Washington. Following construction the Sammamish River lost much of its bed elevation in its upper reach.

Historically, backwater effects from Lake Washington extended beyond the confluence with Little Bear Creek at river mile (RM) 12. This area included extensive forested wetlands, especially at the mouth of North Creek. Historically, the Sammamish River was approximately twice as long as it is today and overflowed its banks regularly. Its corridor was densely forested with cedar, hemlock, and Douglas fir, with willows and deciduous vegetation dominating close to the riverbanks. The Sammamish River corridor was logged extensively from the 1870s through the early twentieth century, by which time it had been essentially cleared of its riparian forest. Small-scale farming was attempted in the floodplain, but farming became feasible on a much larger scale after the opening of the Ballard Locks in 1916 and the subsequent lowering of Lake Washington, which effectively drained most of the sloughs and wetland habitats of much of the river corridor. Lake Sammamish was also affected when Lake Washington was conjoined to Lake Union via the Ship Canal, and with the opening of the Ballard Locks. These actions lowered the elevation of Lake Sammamish as well.

Around the same time (1916), farmers in the Sammamish Valley formed a drainage district, which began to straighten the upper reach of the river. By the mid-1920s the river had largely been placed in its current location, though not at its current depth. The lowering of the lake, the channelization of the river, and the construction of drainage ditches in the river valley eliminated much of the complexity of the floodplain, including wetlands, side-channels, and many spring-fed streams that had flowed into the river from neighboring hillsides.

4.1.4 Lake Union and Lake Washington Ship Canal

Lake Union and the Lake Washington Ship Canal are located in the City of Seattle. The Ship Canal system comprises the Montlake Cut, Portage Bay, Lake Union, the Fremont Cut, and the Salmon Bay Waterway. Lake Union covers approximately 0.91 square mile (581 acres), with an average depth of 32 feet.

The human modifications that have occurred in Lake Union and the Lake Washington Ship Canal have significantly affected the limnology, including temperature and dissolved oxygen. Historically, no surface water connection existed between Lake Union and Lake Washington until the two bodies of water were connected in 1916 as previously mentioned.

Currently, land use along Lake Union consists of commercial and industrial uses dependent upon the waterways including marinas, dry-docks, and commercial shipyards, as well as other commercial and residential developments. Lake Union has experienced greater shoreline modifications than Lake Washington with the construction of industrial and commercial bulkheads and overwater structures.

Shoreline data specific to Lake Union and the Lake Washington Ship Canal are not available. Shoreline conditions for these waterways were estimated based on an inventory conducted by Toft et al. (2003). The inventory was conducted in October 2002; the study area included Lake Union and the Lake Washington Ship Canal and extended west to parts of Shilshole Bay and east to the western edge of Lake Washington. The inventory concluded that 25.29 percent of the shoreline is unretained, and that 17.3 percent of the shoreline's edge is shaded by overwater structures. Docks along these shorelines occurred at a frequency of 32.6 docks/mile and 73.1 percent of these docks were low (less than 2 meters above the water surface).

The Lake Union system provides a transitional zone between the fresh water of Lake Washington and the salt water of Puget Sound. Historically, the lower depths of Lake Union experienced anaerobic conditions year-round as a result of high saltwater concentrations that prevented mixing. Additionally, raw sewage was discharged directly into Lake Union. In the 1960s the City of Seattle began treating sewage.

The Lake Union system still experiences anaerobic conditions that typically begin in June and can last until October. The lack of mixing and a significant sediment oxygen demand can reduce dissolved oxygen levels to less than 1 mg/l, which can prevent fish from utilizing the water column below 10 meters. The temperature baseline of the Lake Union system does not appear to be increasing and can reach 20ºC to 22ºC during the summer. However, the duration of peak water temperatures does appear to be increasing, from an average of 31 days per year in the 1970s to 80 days per year in 2000.

4.2 Discussion of Historical Trend of Environmental Baseline

All the waterbodies described earlier, with the exception of Lake Union and the Lake Washington Ship Canal, historically served as habitat for salmon. The construction of the Ship Canal that connects Lake Washington to Lake Union has created a new migratory route for salmonids and allowed new access to Lake Union. Habitat conditions along the Lake Union system have been degraded and the overall effect of the new migratory pathway on salmon is not fully understood.

Human development, such as the construction of overwater structures along the shorelines in the Lake Washington basin, has been increasing for the past few decades. Recent survey data of Lake Washington suggests that the shoreline is approaching saturation. With the exception of "green" areas such as parks, marshes, and river mouths, most of the remaining shorelines have reached maximum capacity for potential development (Toft 2001).

For the past few decades, the annual percent increase in the total number of docks along Lake Washington has been declining from 5.7 percent in the 1940s to 1.8 percent in the 1960s and to 0.5 percent in the 1990s. While the percent increase in the number of recreational docks is following similar trends as the total number of docks, the annual percent increase in the number of large marina docks increased significantly during the late 1970s and 1980s. This increase resulted in a doubling of the number of large marina docks since the 1960s; however, this relatively rapid rate of increase has also stabilized in recent years.

Section 5. Effects of the Action

The following sections discuss anticipated effects from the activities proposed for authorization under this RBE. The ESA requires that federal agencies consider several types of effects, as defined below.

Direct effects are effects from actions that would immediately remove or destroy habitat, harm (injure or kill) species, or adversely modify designated critical habitat. Direct effects include actions that would potentially remove or destroy habitat, or displace or otherwise influence the species, either positively (beneficial effects) or negatively (adverse effects).

Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. Indirect effects may include impacts to food resources, or foraging areas, and impacts from increased long-term human access.

Effects from interdependent and/or interrelated actions include effects from actions that (1) have no independent utility apart from the primary action, or (2) are part of a larger action and depend on the larger action for their justification, and/or (3) are required as part of the action, including maintenance and/or use of the project, as well as other actions that would be carried out to implement, maintain, and/or operate the project.

Conservation measures are measures proposed to minimize or compensate for project effects on the species under review. Unless stated otherwise, the effects determinations, as defined below, are based on the assumption that conservation measures would be incorporated into the project.

The effects determinations are the specific conclusions of the biological assessment concerning the overall effect of the project on each species and/or critical habitat type. Possible categories for listed species and designated critical habitat are (1) no effect; (2) may affect, not likely to adversely affect; or (3) may affect, likely to adversely affect.

5.1 Authorized Activities and Their Effects

This RBE proposes to analyze the impacts of recurring activities that are similar in nature and have minor individual and cumulative adverse impacts on the aquatic environment. Table 5-1 lists each of the activities to be analyzed under this RBE, their associated construction and operation components, and their direct and indirect effects. In the following sections, each of the listed direct and indirect effects is discussed in greater detail. Please refer to Section 2.2 of this document for detailed descriptions of each of the listed activities and Section 7 of this document for related conservation measures.

Table 5-1. Regional General Permit Authorized Activities and Their Direct and Indirect Effects

Authorized Activity	Construction and Operation Impact Mechanisms	Direct Effects	Indirect Effects	Relevant Conservation Measures (Refer to BE Section 7)
Future Maintenance	▪ Operation of Heavy Equipment ▪ Pile Driving ▪ Boat Mooring	▪ Noise ▪ Water Quality	▪ Increased Use ▪ Shading ▪ Predator Habitat	▪ Section: 7.11
Driving Moorage Piling	▪ Operation of Heavy Equipment ▪ Pile Driving ▪ Boat Mooring	▪ Noise ▪ Water Quality	▪ Increased Use ▪ Shading	▪ Sections: 7.1, 7.2, 7.5, 7.6, 7.7, 7.8, 7.9, 7.10, 7.12, 7.13, 7.13, 7.14, 7.15, and 7.16
Float Installation	▪ Operation of Heavy Equipment ▪ Pile Driving ▪ Boat Mooring	▪ Noise ▪ Water Quality	▪ Increased Use ▪ Shading ▪ Predator Habitat	▪ Sections: 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8, 7.9, 7.10, 7.15, and 7.16
Pier, Ramp, and Ell Construction or Expansion	▪ Operation of Heavy Equipment ▪ Pile Driving ▪ Boat Mooring ▪ Shoreline Modification	▪ Noise ▪ Water Quality ▪ Riparian Vegetation Removal	▪ Increased Use ▪ Shading ▪ Predator Habitat ▪ Degradation of Shoreline Habitat ▪ Altered Water Flow ▪	▪ Sections: 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.8, 7.9, 7.10, 7.12, 7.13, 7.15, and 7.16
Removal of Existing Structure	▪ Operation of Heavy Equipment ▪ Pile Removal	▪ Water Quality ▪ Noise	▪ Improvement of Shoreline Habitat	▪ Sections: 7.1, 7.3, 7.5, 7.6, 7.7, 7.8, and 7.9

5.2 Direct Effects

The primary direct effects of the activities analyzed within this RBE include

- temporary impacts to water quality from increases in turbidity, as well as potential for accidental spills of hazardous materials,
- noise generated from pile driving and operation of construction equipment, and
- removal of riparian vegetation along shoreline habitats.

The following sections describe these direct effects in detail.

5.2.1 Temporary Water Quality Impacts

During construction, proposed activities could affect water quality by producing suspended sediments. There is also potential for an accidental spill of hazardous materials.

Overall, project activities could cause temporary, short-term, and localized effects to water quality. However, such effects are expected to be minor and would not adversely affect listed species. Projects analyzed in this RBE will be relatively small in scale. Timing restrictions will minimize contact with aquatic habitats and avoid potential effects to listed species. Other measures that would reduce potential impacts are discussed below.

5.2.1.1 Increased Turbidity

Mechanisms of Impact. Temporary local increases in turbidity may occur as sediments are mobilized during the installation of pilings and anchors, and from prop wash associated with a work tug or barge if one is used during construction. The duration and intensity of elevated turbidity levels depend upon the quantity of materials suspended, the particle size of sediments, the amount of affected area, and the physical and chemical properties of the suspended sediments (NMFS 2001). Turbidity within the immediate vicinity of the construction activity (10 meters) would likely exceed background levels and could potentially affect fish and their prey by causing gill trauma, temporarily depleting the area of dissolved oxygen, and covering bottom-dwelling benthic communities (Martin et al. 1977, Carrasquero 2001, Corps 2002).

Measures to Reduce Potential Impacts. The work area shall be isolated from the surrounding waterbody by a properly installed silt screen or similar sediment containment device whenever practicable. Please refer to Section 7 Conservation Measures of this BE.

Conclusions. Although elevated turbidity levels may cause stress to salmonid species, studies by Redding et al. (1987) found that relatively high levels of suspended sediment (2,000 to 2,500 mg/l) did not appear to cause significant stress to yearling salmon. Determining how much of an increase in turbidity will result from project activities is difficult, but elevated turbidity levels are expected to be temporary and short-term. Temporary, short-term, and localized elevations in turbidity associated with covered activities are not expected to result in mortality or to have any significant physiological effects on threatened or endangered salmonids, their habitat, or their prey resources.

5.2.1.2 Accidental Spill of Hazardous Materials

Mechanisms of Impact. Machinery required for construction will operate near the water from either the shoreline or a floating barge. No machinery will operate directly within waters other than to place or remove materials via an extension of an excavator arm or similar device. However, the risk that petroleum products will accidentally leak or spill into the water does exist.

Measures to Reduce Potential Impacts. Adherence to timing restrictions for in-water work will minimize potential impacts to salmonids should an accidental spill occur.

Creosote, pentachlorophenol (Penta), copper naphthalene, or other wood preserving chemicals that could leach into the water column will not be used to treat piling and lumber used in projects permitted through this RBE, with the exception of wood treated to the specifications of the *Best Management Practices for the Use of Treated Wood in Aquatic Environments* developed by the Western Wood Preservers Institute (1996). Please refer to Conservation Measures 7.12 and 7.13 in Section 7 of this BE for additional information.

Conclusions. The risk to fish health would depend on the type of contaminant spilled, time of the year, amount spilled, and success of containment efforts (Corps 2002). The level of impact to the aquatic environment is expected to be minor because of the small amounts of petroleum products that could potentially be spilled during typical construction activities. Timing restrictions will also limit potential impacts to listed species.

5.2.2 Noise from Pile Driving and Construction Equipment

Increased noise is expected during pile driving and operation of machinery during certain permitted activities. The noise from pile driving would cause temporary, short-term increases in underwater and airborne sound events. Noise created by construction equipment may increase noise levels above ambient conditions.

Noise generated by pile driving and the operation of heavy equipment may affect salmonids or bald eagles. Potential effects would be minimized through the measures discussed below.

Mechanisms of Impact—Salmonids. The vibratory energy and noise of piling driving can adversely impact fish species in the project vicinity. The vibratory energy and noise level generated during pile driving can vary depending upon the size of the piling and the type of material the piling is made of. In general, the use of a compression-hammer pile driver generates a typical peak underwater sound around 105 dB that could be heard by salmonids up to 2,000 feet away from the point-source noise (Feist 1991, Feist et al. 1992). This noise could cause fish to avoid the work area while pile driving is occurring, thus affecting foraging and migration patterns within a 2,000-foot radius of the sound source. One study examining salmonid distribution and behavior during pile driving activities revealed a two-fold increase in salmonid presence on days during which pile driving did not occur (Feist 1991).

Evasive response by salmonids from noise effects could also result in juvenile salmonids abandoning refuge areas and increasing risks of predation. Salmonids have been observed engaged in startle behavior characterized by sudden swimming bursts. Pacific herring have shown an avoidance response to sound stimuli (Schwarz and Greer 1984). Sound has also been shown to affect growth rates, fat stores, and reproduction in some species of fish (Meier and Horseman 1977; Banner and Hyatt 1973). Auditory masking and habituation to pile driving sounds may also decrease the ability of salmonids to detect approaching predators (Feist 1991, Feist 1992). Intense noise may also adversely affect fish eggs and embryos; however, possible effects have not been quantitatively studied (Carrasquero 2001).

While the distance that loud noise travels within water can be measured and quantified, scientific literature quantifying the effects to salmonids is at times conflicting. For example, in a study examining the effects of impact pile driving on salmonid behavior in the Columbia River, the threshold distance for an avoidance response by salmonids was determined to be 10 feet from the impact source (Carrasquero 2001).

Recognizing these discrepancies in the literature, the WDFW established a protection area for pile driving effects of 300 feet. This is due to the fact that salmon, primarily sockeye salmon and to a lesser degree chinook salmon, are known to spawn on beaches of Lake Washington, and eggs and embryos are unable to avoid impacts from pile driving activities (Carrasquero 2001).

Mechanisms of Impact—Bald Eagles. Airborne noise generated during pile driving could be above ambient background noise levels and therefore potentially affect bald eagles up to 1 mile from the project location (Corps 2001). Loud noises can displace bald eagles from foraging areas and flush adults from nests, causing abandonment or reduced reproductive success (Rodrick and Milner 1991).

Bald eagles nest near shorelines and are generally intolerant of human activities during the nesting season. Mechanized equipment can generate noise levels of approximately 60 to 110 dB. The shorelines of Lake Washington, Lake Sammamish, the Sammamish River, and Lake Union are moderately to heavily developed with residential homes and commercial and industrial facilities. Noise within the Lake Washington basin results from airplane traffic associated with Seattle-Tacoma International Airport and Boeing Field, as well as private airplanes equipped with floats that land and take off on Lake Washington and Lake Union. Vehicle traffic associated with Interstate 90, State Route 520, and the numerous side streets near shorelines in the Lake Washington basin, as well as recreational boating, and various other human activities also increase the ambient noise levels within the action area.

The ambient noise levels in the Lake Washington basin likely vary from 35 dBA, the ambient noise level of a semi-rural area, to 65 dBA, the ambient noise level near a freeway. The ambient noise level of a property located directly adjacent to Interstate 90 is likely higher than a property located near Marymoor Park. Thus, site specific factors determine whether the noise generated by the operation of heavy equipment during project construction will be greater than existing ambient noise levels.

Measures to Reduce Potential Impacts. The duration of pile driving activities and the probability that those activities will affect listed species will be minimized by

- reducing the number of pilings to be installed (by maximizing the distance between pilings),
- adhering to timing restrictions,
- complying with guidelines for sound attenuation for installing steel pilings with an impact hammer, and
- observing distance guidelines.

See Tables 7-1 and 7-2 in Section 7 Conservation Measures of this BE for work windows related to bald eagles and in-water work, respectively. For the purposes of this RBE, loud noises such as pile driving are restricted within 0.5 mile (2,600 feet) of unscreened bald eagle nests and 0.25 mile (1,300 feet) of screened bald eagle nests (USFWS 1986) during the nesting season. Please refer to Section 7 of this document for detailed conservation measures.

Conclusions. Adherence to approved work windows will avoid impacts to beach spawning salmonids. Impacts to nesting, roosting, foraging, or wintering bald eagles will be avoided or minimized through the adherence to timing and distance restrictions for construction activities that generate noise levels above ambient conditions.

5.2.3 Removal of Riparian (Shoreline) Vegetation

Riparian vegetation shades nearshore areas and can moderate water temperatures. Shoreline vegetation can also provide a source of LWD that affords cover for juvenile salmonids, as well as other fish species, including salmonid predators. Riparian vegetation that overhangs the water provides habitat for terrestrial invertebrates that may fall into the water, as well as leaf litter that aquatic invertebrates feed upon. Both terrestrial and aquatic invertebrates provide forage for juvenile salmonids. LWD also traps sediments and stabilizes and protects shorelines from wave scour. Additionally, bald eagles use trees adjacent to waterbodies for nesting, roosting, perching, and foraging (Rodrick and Milner 1991).

The construction or expansion of residential overwater structures may require removal of riparian vegetation. The indirect effects on salmonids and bald eagles of reducing shoreline vegetation are described in Section 5.3. Direct effects and measures to minimize them are described below.

Mechanisms of Impact. Residential overwater structures are often associated with bulkheads, riprap, and landscaping that preclude riparian vegetation. The reduction of shoreline woody vegetation is the primary cause of reduced LWD recruitment potential, which in turn reduces habitat components for salmonids. Removal of mature trees could also impact bald eagle feeding and breeding patterns.

Measures to Reduce Potential Impacts. To minimize potential direct impacts to bald eagles, mature trees shall not be removed for activities permitted by the RBE. Revegetation of disturbed areas shall occur, and a 5-year monitoring plan shall be implemented.

To reduce long-term impacts to riparian vegetation and improve currently degraded shoreline conditions, riparian vegetation impacted during construction activities will be replaced with native vegetation appropriate for the site, where practicable. The removal of riparian vegetation will be limited to the minimum amount necessary to accomplish each project. Planting of a 10-foot-wide buffer of native vegetation will be required along the entire length of the shoreline immediately landward of the ordinary high water line (OHWL). Please refer to Section 7, Conservation Measure 7.4 of this document for additional information.

Conclusions. Removal of riparian/shoreline vegetation will be limited to the minimum necessary to accomplish construction of each project. Planting of a 10-foot-wide buffer of native vegetation along the entire length of the shoreline will improve shoreline conditions for salmonids by providing detritus and aquatic macroinvertebrates, as well as terrestrial macroinvertebrates for salmonids to forage on.

5.3 Indirect Effects

The primary indirect effects of the authorized activities within this RBE include

- degradation of the shoreline habitat,
- creation of potential salmonid predator habitat,
- shading and reductions in littoral productivity,
- increased boating activity, and
- alterations to water flow.

The following sections describe these indirect effects in detail.

5.3.1 Degradation of Shoreline Habitat

Mechanisms of Impact. The construction or expansion of residential overwater structures includes elements that can alter both shoreline and aquatic environments, affecting salmonids and bald eagles. Riparian vegetation is often removed where docks attach to the shore. Riparian vegetation provides shading that moderates water temperatures during summer months and creates refuge for juvenile salmonids.

The incremental reduction in overwater riparian shading could, over time, affect water temperatures and habitat complexity. Plant roots stabilize shorelines and streambanks, while riparian trees provide LWD recruitment. LWD input can increase in-water habitat complexity while providing organic matter that increases productivity in the aquatic food chain (Carrasquero 2001).

Measures to Reduce Potential Impacts. To minimize the potential effects from the removal of riparian vegetation, all projects with activities linked to the shoreline will be required to implement shoreline planting to maintain or improve existing shoreline riparian conditions. Refer to Section 7.4 of this document for additional information.

New shoreline structures will be designed with sloped shorelines and/or would incorporate natural coves and other natural and more complex features, as opposed to shoreline armoring, to provide salmonid refuge and promote macroinvertebrate productivity. Please refer to Section 7 of this document for detailed conservation measures.

Conclusions. Many shoreline areas within the action area have reduced riparian vegetation. The implementation of planting plans would improve the existing shoreline condition within the Lake Washington basin.

5.3.2 Creation of Potential Salmonid Predator Habitat

Mechanisms of Impact. The construction of new residential overwater structures could increase habitat conditions preferred by largemouth and smallmouth bass, as well as other potential juvenile salmonid predators. This could increase the likelihood of predation on juvenile salmonids. While no studies have quantified the effects of overwater structures on predator-prey interactions, the Corps and USFWS now consider any new overwater structure to impact juvenile salmonid migration by increasing potential habitat for predators (Corps 2002).

It has been documented that smallmouth bass (a known predator of juvenile salmonids) have a strong affinity to overwater structures and use such habitat for spawning, rearing, and foraging (Carrasquero 2001). Contrasting studies, however, found that in still waters (protected harbors) with steeply sloped shorelines, the northern pikeminnow preferred areas of fast-moving water with low-velocity microhabitats. Such habitats can be created by pilings. Thus the construction of overwater structures seems to benefit smallmouth bass in lakes where current velocities are reduced, while benefiting northern pikeminnow in free-flowing river systems where in-water obstructions create low-velocity microhabitats (Carrasquero 2001).

Juvenile salmonids utilize nearshore, shallow water, low-velocity habitats for rearing, and foraging within free-flowing streams and still-water reservoirs and lakes. Overwater structures create an overlap of predator and juvenile salmonid habitat use within the nearshore environment, which can cause increased predation on juvenile salmonids. Therefore, it may be that the construction of new or expansion of existing overwater structures permitted under this RBE will create additional predator habitat and may contribute to juvenile salmonid predation.

The primary predator of juvenile chinook salmon within the littoral zone from January through June, and the limnetic zone from July through December, appears to be cutthroat trout. A small proportion of northern pikeminnow, yellow perch, and smallmouth bass reside in nearshore regions during winter, but the majority move inshore in the spring as water temperatures in nearshore areas begin to increase. The distribution of these fishes overlap primarily with the peak outmigration of chinook salmon through the littoral zone, whereas the overlap of cutthroat trout and chinook salmon is continuous. Sculpins are also present in the littoral zone year-round and are known to prey on juvenile chinook salmon. In mid-summer, temperatures in the littoral zone become undesirable for juvenile chinook salmon, and the majority leave Lake Washington or seek cooler temperatures away from the littoral zone, thus separating themselves from littoral predators but remaining vulnerable to cutthroat trout and potentially prickly sculpin (Center for Lake Washington Studies 2003).

Measures to Reduce Potential Impacts. Conservation measures intended to avoid or minimize impacts to salmonids from an increase in potential predator habitat include

- avoiding construction of new structures over vegetated shallow habitat,
- restricting float size,
- elevating ramps and piers,
- maximizing the spacing between pilings, and

- leaving in-water and shoreline habitat features in place.

Please refer to Section 7 of this document for detailed conservation measures.

Conclusions. The conservation measures are intended to decrease shading of nearshore habitats and maintain littoral productivity, increase habitat complexity and production of aquatic and terrestrial macroinvertebrates, and decrease potential habitat for salmonid predators. These measures are anticipated to discourage potential predator use by minimizing or avoiding the creation of the type of habitat that appears to be preferred by predators (that is, by restricting shading, minimizing pilings, and restricting structure size).

5.3.3 Shading and Reductions in Littoral Productivity

Mechanisms of Impact. The construction of small piers, floats, and boat lifts causes increased shading of in-water habitats. The reduction in light affects phytoplankton and aquatic macrophytes, and this condition can reduce littoral productivity and decrease the abundance of salmonid prey organisms. Consequently, increased shading can affect local plant and animal community structure and species diversity (Carrasquero 2001, NMFS 2001). The most significant impacts to phytoplankton production occur when shading substrates at a depth of 1 to 2 meters.

Shading may limit production of algae or aquatic vegetation, depending upon the size of the structure and amount of shading. Shading also reduces the primary production of phytoplankton. However, algae primary production may compensate for the loss of phytoplankton primary production.

Measures to Reduce Potential Impacts. To avoid or minimize impacts to littoral productivity:

- Piers will be limited to 4 feet wide with 60 percent open area to minimize shading of nearshore areas.

- Construction will be limited within 30 feet of the OHWL to decrease potential shading related impacts to littoral productivity.

- Riparian vegetation plantings will be required to improve nearshore conditions over time.

See Section 7, Conservation Measure 7.15 of this document for further details.

Conclusions. The structure design criteria are intended to minimize or avoid potential impacts of residential overwater structures, and conservation measures are intended to improve baseline conditions.

5.3.4 Increased Boating Activity

Mechanisms of Impact. Construction of new or expanded residential overwater structures can promote increased levels of boating activity. Potential impacts from increased boating activity in shallow water include elevated turbidity levels from prop wash, uprooting of aquatic vegetation, pollution from exhaust, leaks or spills of petroleum products, temporary displacement of salmonids from the physical presence of the boats or people swimming, and salmonid entrainment in the propeller (NMFS 2001).

Wave action from increased boating activity can also increase shoreline erosion and uproot emergent vegetation, thus degrading shoreline conditions and potential salmonid habitat. Increased shoreline armoring to prevent continued erosion from boat wakes can further degrade shorelines and nearshore aquatic habitat.

Elevated turbidity levels can injure or stress affected fish as described above. The reduction of aquatic vegetation can reduce littoral productivity and decrease the abundance of potential salmonid prey organisms.

Measures to Reduce Potential Impacts. New floats, piers, and boat lifts will not be located within 100 feet of the mouth of any river, stream or creek, or within 300 feet of the mouth of any river or stream identified as containing federally listed salmonids or that is targeted for salmonid recovery. Please refer to Section 7 of this document for detailed conservation measures. Additionally, boats will be moored over deep water, where impacts to littoral productivity will be avoided or minimized.

Conclusions. Potential impacts to salmonids, shorelines, and nearshore aquatic habitats will be minimized or avoided by implementing design and location criteria for residential overwater structures analyzed under this RBE.

5.3.5 Alterations to Water Flow

Mechanisms of Impact. A residential overwater structure can create localized eddies during wind-generated lake currents and on free-flowing streams. The structures can also alter shoreline current patterns that promote increased or altered shoreline erosion, as well as changes in littoral drift patterns. Alterations that increase shoreline erosion can increase the turbidity during storm events, which can affect littoral drift, scour and deposition, and potential predation of juvenile salmonids.

Measures to Reduce Potential Impacts. To minimize the effects of residential overwater structures on water flow and littoral drift patterns, there will be a limit on how far new or expanded structures can extend into a waterbody (limited by the maximum square footage restrictions). Shoreline armoring will not occur in association with a new residential overwater structure or the expansion of an existing overwater structure. Please refer to Section 7 of this document for detailed conservation measures.

Conclusions. Design of residential piers analyzed under this RBE will prohibit the installation of pilings within 30 feet of the OHWL as well as limit the extent a structure can extend into a waterbody. Such design criteria shall decrease the potential for shoreline erosion and turbidity. Additionally, shoreline armoring will not be permitted under this RBE, which will further reduce the potential for shoreline erosion.

5.4 Effects from Interdependent and Interrelated Actions

No interdependent or interrelated actions will be associated with the permitted activities within the RBE. All permitted activities will be single and complete actions; therefore no effects from interdependent or interrelated actions will occur.

5.5 Effects to the Environmental Baseline

The incorporation of conservation measures summarized in Section 5.6 and detailed in Section 7 of this BE will ensure that degradation of the environmental baseline is minimized or avoided. Historic changes to the environmental baseline from the impoundment of waters and intensive development within the action area have significantly altered and degraded aquatic and nearshore habitats. Implementation of conservation measures will improve shoreline conditions through enhancing riparian areas and minimizing overwater structures. Adherence to in-water and landward construction timing restrictions will serve to protect aquatic and terrestrial species during critical nesting, spawning, and foraging life stages.

5.6 Overview of Conservation Measures

The activities analyzed in this RBE will incorporate conservation measures into the design. These measures will reduce potential impacts to shoreline, nearshore, and aquatic habitats so that at a minimum the environmental baseline will be maintained. The conservation measures will prevent degradation of the environmental baseline by

- protecting and enhancing shoreline riparian vegetation,
- minimizing the creation of potential habitat for salmonid predators,
- minimizing shading of littoral habitat through structure design guidelines,
- promoting boat moorage and boating activity away from shallow littoral habitat,
- establishing in-water work windows for the protection of salmonids, and
- establishing construction restrictions near documented nesting, feeding, or spawning habitat of federally listed species.

These conservation measures will become required conditions of each permit issued by the Corps using this RBE. The above-mentioned conservation measures are described in detail in Section 7 of this document.

Section 6. Cumulative Effects

6.1 Scope

In the context of the ESA, cumulative effects encompass the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the covered area. Future federal actions, including those that are unrelated to the proposed action, are not considered in the cumulative effects analysis because they require separate consultation pursuant to Section 7 of the ESA.

This cumulative effects analysis addresses impacts in the context of general trends in population and land use within Washington State, with a focus on King County that includes areas in or adjacent to those impacted by actions associated with the RBE.

6.2 Population Growth

Washington's current population of about 5.8 million people has increased by about 1 million since 1990. The majority of the population growth has been concentrated in the west, with the large counties surrounding Puget Sound, as well as Clark County, accounting for 72 percent of the increase (WOFM 1999).

Since 1990, King County has grown 15.2 percent, which is approximately 6 percent less than the 21.1 percent growth experienced statewide during the same time (U.S. Census Bureau 2000).

Population densities in the state are highest in the lowland areas surrounding Puget Sound, the Yakima River valley east of the Cascade Mountains, Clark and Cowlitz Counties along the Columbia River, the Spokane area, the I-5 corridor in Lewis County, and the northern edge of the Olympic Peninsula. Statewide, the average population density is about 89 people per square mile, while densities in King County are 817 people per square mile (U.S. Census Bureau 2000).

Forecasts for population growth predict an additional 1.2 to 2.5 million people will reside in Washington by 2020 (OFM 1999). In the shorter term, between 6 and 6.5 million are predicted to call Washington home by 2005. Future growth patterns should mirror historical patterns, with most growth in the Puget Sound area, along the I-5 corridor, and in selected valleys and highway corridors in eastern Washington.

6.3 Residential, Commercial, and Infrastructure Development

Intuitively, population growth results in increasing residential and commercial development. Improvements and upgrades to infrastructure (including highways, other transportation facilities, and utilities) will likely track closely with increased residential and commercial development. Primary effects of land development include direct habitat loss, decreased water quality, contamination of waterways and uplands, changes to runoff patterns, habitat fragmentation, isolation of wildlife populations, and a decrease in habitat diversity. As development increases, the general quantity and quality of habitat suitable for threatened and endangered species will most likely decrease.

The amount of build-out associated with the projected population growth will likely lead to further habitat degradation. Actions taken to mitigate for the potential impacts of development, such as avoidance of habitat critical to species survival and strong urban/rural boundaries, can help minimize and slow the rate of habitat degradation, and in some instances avoid degradation.

6.4 Agriculture

In 1997, Washington had over 15 million acres of land dedicated to agricultural production (USDA 1997). Between 1992 and 1997, lands dedicated to farming decreased by 3 percent. This result probably reflects the industry's reliance on limited water supplies, particularly given the recent statewide drought, and on crop markets, in which the export market has decreased by 29 percent over the last 10 years (OFM 1999). The top five commodities sold in the state include fruits, nuts and berries; cattle and calves; dairy products; other crops, including potatoes and peanuts; and wheat (USDA 1997).

In western Washington agriculture began in the 1820s and was encouraged by programs like the Homestead Act of 1862. Between 1945 and 1992, 75 percent of the agricultural lands in King County were converted to other uses (from 165,635 acres to 42,290 acres), primarily commercial and residential developments. Today only 3 percent of King County is considered agricultural land, with most agriculture consisting of small, part-time operations specializing in livestock, nursery and greenhouse products, and fruits and vegetables (Kantor 1998).

Assuming future trends mirror the historical pattern, agricultural practices will continue to decrease and commercial and residential development will increase in King County. However, as mentioned previously, only 3 percent of the land within King County is considered agricultural land. Conversion of this land to commercial or residential development will negatively affect fish and wildlife because of increases in impervious surface area and human activity.

6.5 Fishing

Fishing activities, both commercial and recreational, can result in the direct take of listed fish species and a decreased forage base for other listed species, such as bald eagles. Populations of salmon, likely the most studied and volatile fishery in the state, have steadily declined since the early 1970s, and fishery and water quality laws are regularly updated to protect salmon and their habitat. Other fish stocks, including bull trout and Dolly Varden, have also experienced substantial population declines, and are similarly protected by more stringent environmental and fisheries protection laws.

Recreational fishing within the action area is permitted with retention of salmon over 12 inches, and steelhead or rainbow trout over 20 inches. Sockeye salmon must be released. Dolly Varden and bull trout caught in Lake Washington must be released (WDFW 2002). Catch-and-release requirements relieve some of the fishing pressure on listed species, although listed species are often caught unknowingly and not returned as required. This failure could result in adverse impacts to threatened and endangered fish in local watersheds.

6.6 Forestry

Timber harvest in Washington has reached its lowest level since the 1970s (OFM 1999). The downward trend is commonly correlated to the environmental policies of the 1980s that resulted in the removal of sizable portions of federally owned forests available for timber harvest.

The Puget Sound region of Washington state, including King County, experienced a 7.3 percent increase in land converted from forest zone to suburban zone, and a 15.7 percent increase in land converted from forest zone to urban zone, between 1979 and 1989 (MacLean and Bolsinger 1997). In 1979 the total land area in private ownership in the King County was 1,228 square miles (786,000 acres), of which 642 square miles (411,000 acres) was considered primary forest zone, 333 square miles (213,000 acres) was considered suburban zone, and 253 square miles (162,000 acres) was considered urban zone. By 1989 the primary forest zone had decreased to 573 square miles (367,000 acres), while the suburban zone and the urban zone had both increased to 344 square miles (220,000 acres) and 312 square miles (200,000 acres), respectively (MacLean and Bolsinger 1997).

6.7 Pollutant Discharge

Air and water pollution can degrade habitat and have lethal and sub-lethal effects on fish and wildlife. Increased population typically causes increased air and water pollution. Developed areas also generate effluent, and runoff is often polluted with a variety of substances. In the early 1990s, Washington led the nation in the weight of pollutants discharged directly to surface waters (WDNR 2000). As of 1999, nearly 60 percent of the lakes, steams, and estuaries studied failed to meet water quality standards (WDNR 2000).

For the year 2000, the Puget Lowlands Ecoregion, which includes the action area, showed an increasing trend for pH and turbidity in the fresh waters that were evaluated, and decreasing trends for temperature, dissolved oxygen, total nitrogen nutrients, and fecal coliform bacteria (Ecology 2001).

Data collected in 1993 and 1994 at monitoring stations on the Lake Washington Ship Canal near the outlet of the basin, and the Sammamish River near the confluence with Lake Washington, indicate that the lake did not exceed water quality standards for temperature, dissolved oxygen, total nitrogen nutrients or fecal coliform bacteria (Ecology 2002). However, the 1998 303(d) list indicates that Lake Sammamish did exceed fecal coliform bacteria criteria on two occasions; the Sammamish River did exceed dissolved oxygen criteria on one occasion, fecal coliform criteria on four occasions, pH criteria on one occasion, and temperature criteria on three occasions. The Lake Union/Lake Washington Ship Canal exceeded Dieldrin and sediment bioassay criteria on one occasion each, and Lake Washington exceeded fecal coliform criteria on 18 occasions and sediment bioassay criteria on one occasion (Ecology 1999).

Ongoing improvements to state monitoring programs will more effectively mitigate acute pollutant sinks and sources specific to targeted regions in the state. While future trends in pollutant discharge are difficult to estimate, discharges will probably continue and are likely to degrade habitat for federally listed species.

Section 7. Conservation Measures

The conservation measures described below are required conditions of each permit issued by the Corps under the RBE.

7.1 Construction Timing

In order to protect Puget Sound chinook salmon, Coastal/Puget Sound bull trout, and bald eagles, work shall adhere to the work windows found on the Corps, Seattle District, Regulatory Branch web page at www.nws.usace.army.mil/reg.html under Endangered Species Act Programmatic Consultation Work Windows.

Note: Please contact the U.S. Fish and Wildlife Service at (360) 753-9440 to determine the distance of the proposed project site in relation to the nearest bald eagle nest site and wintering concentration.

7.2 Proximity to Wetlands

No structure permitted herein shall be installed in or within 100 feet of a wetland or within 100 feet of either side of the mouth of any river, stream, or creek. “Wetlands” means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. This will avoid potential behavioral changes to migrating juvenile salmonids and impacts to wetlands.

7.3 Habitat Features

Existing habitat features (e.g., large and small woody debris, substrate material, potential bald eagle perch trees, etc.) shall not be removed from the riparian or aquatic environment. If invasive weeds (e.g., milfoil) are present, removal may occur by non-chemical means only with authorization from WDFW.

7.4 Mitigation Required by Corps Permit

7.4.1 Revegetation of Disturbed Riparian Areas

The purpose of revegetating disturbed riparian areas is to offset the temporary loss to the aquatic environment resulting from construction of a new overwater structure or expansion of an existing overwater structure. The planting of native vegetation establishes a riparian plant community and associated food web that can be utilized by salmonids as they migrate through the project area.

Disturbance of bank vegetation will be limited to the minimum amount necessary to construct the project. Disturbed bank vegetation will be replaced with native, locally adapted species appropriate for the site. Herbaceous plantings shall occur no later than April 1 of the year following completion of project construction. However, it is recommended that plantings occur during the first fall following completion of project construction, which may increase the survivability of the plantings. Woody vegetation components shall be planted in the fall or early winter. The permittee shall take appropriate measures to ensure revegetation success.

Recommended native shrubs include, but are not limited to, *Salix sitchensis, S. scouleriana, S. exigua, S. prolixa, S. lasiandra, and Cornus stolonifera.* Recommended native trees include, but are not limited to, *Populus trichocarpa, Pseudotsuga menzeisii*. When revegetating riparian areas, shrubs will be planted at intervals of 3 feet on center, and trees will be planted at intervals of 10 feet on center.

Because of the potential cumulative impacts of numerous floating and stationary structures to be analyzed under this RBE, impact reduction measures must be implemented. Impact reduction measures consist of planting emergent vegetation (if site appropriate) and a buffer of vegetation a minimum of 10 feet wide along the entire length of the shoreline immediately landward of the OHWL. A path less than 6 feet wide is allowed through the buffer for access to the pier. At least five native trees will be included in the impact reduction planting including one or more evergreen trees and two or more trees that like wet roots (e.g., willow species).

Prior to issuance of a permit, the Corps must approve the prospective permittee's impact reduction plan and species list. The impact reduction planting must be completed within 12 months of the Corps' issuance of a permit.

Based on site-specific impacts, the Corps may require additional compensatory mitigation in addition to the revegetation of disturbed riparian areas. If required, the permittee will submit a compensatory mitigation plan to the Corps. The mitigation plan will describe the actions the permittee will take to restore, enhance, protect, and/or replace the aquatic ecosystem functions that would be lost as a result of the of the proposed work.

The critical elements of the compensatory mitigation plan include

- a statement of the specific goals and objectives of the plan;
- detailed descriptions and drawings of the proposed project including, construction, grading, and planting activities;
- provisions for monitoring and reporting on the progress of the plan's implementation;
- performance standards that measure the ecological success of the plan;
- a long-term mitigation area management plan, including a vegetation management plan; and

- any necessary protective covenant, such as a deed restriction or conservation easement.

7.4.2 Revegetation Performance Standards

Revegetation of all disturbed riparian areas will be completed no later than April 1 of the year following completion of project construction. However, it is recommended that plantings occur in the first fall following completion of project construction, to increase the survivability of the plantings.

One hundred percent (100 percent) survival of all native vegetation planted will be required during the first and second years after planting riparian/shoreline vegetation. The third, fourth, and fifth years after planting, 80 percent survival will be required with 100 percent survival of trees. Individual plants that do not transfer successfully and subsequently die must be replaced with native vegetation taken from the approved species list.

7.4.3 Revegetation Monitoring Reports

Monitoring reports will be submitted to the Corps for all projects that require revegetation of disturbed riparian areas. Reports will contain the following elements.

- A status report on mitigation construction, including as-built drawings, must be submitted to the Corps 12 months from the date the Corps issues a permit. Annual status reports on project construction and revegetation are required until project construction and revegetation are complete.

- Monitoring reports will be due annually for 5 years from the date the Corps accepts the as-built drawings. The monitoring report will include written and photographic documentation on vegetation mortality and replanting efforts.

7.4.4 Removal of Plantings in Revegetated Areas

The loss of riparian vegetation, including the removal of plantings in revegetated areas, can have negative impacts on salmonids by reducing habitat structure and foraging opportunities that are critical components to the migratory corridor. Because of these potential negative impacts, additional planting may be required on sites where the vegetation has been removed. The determinations for the need for additional planting requirements will be made on a case-by-case basis by the Corps, in accordance with applicable Department of the Army enforcement and compliance regulations.

7.5 Disposal of Construction Debris

All construction debris will be disposed of at an appropriate upland facility, located in such a manner that it cannot enter waters of the United States, including wetlands.

7.6 Heavy Equipment

If heavy equipment is used during construction of a project, the equipment shall be clean and free of external oil, fuel, or other potential pollutants. All equipment shall be inspected daily prior to use to ensure the equipment has no leaks of potential pollutants. Should a leak develop during use, the leaking equipment shall be removed from the site immediately and not used again until it has been adequately repaired. No equipment will be stored or fueled in proximity to surface water such that the activity could adversely affect the waterbody.

7.7 Operation of Equipment

Heavy equipment shall operate from on-shore staging areas, with the exception of an excavator arm or bucket. Pile drivers shall use constructed work platforms (e.g., a barge). Equipment shall operate from the top of a bank, dry gravel bar, work platform, or similar out-of-water location. Equipment shall operate in a manner that minimizes the suspension of particulates.

All equipment used in or around waters shall be clean and inspected daily before use to ensure that the equipment has no fluid leaks. Should a leak develop during use, the leaking equipment will be removed from the site immediately and not used again until it has been adequately repaired. Equipment should be stored and/or fueled at least 100 feet from any surface water where possible.

7.8 Work in the Dry

Work that disturbs the substrate, bank, or shore of a water of the United States shall occur in the dry whenever practicable.

7.9 Isolation of Work Area

In-water work areas shall be isolated from the surrounding waterbody by properly installed silt screen or similar sediment containment device whenever practicable. The permittee shall remove these temporary sediment containment devices when they are no longer necessary to protect the surrounding waterbody.

7.10 Preservatives

Any paint, stain, or preservative applied to components of an overwater structure must be completely dried or cured prior to installation. Creosote, pentachlorophenol (PCP), copper naphthalene, chromated copper arsenate (CCA), or other leachable protective chemicals shall not be used to treat pilings and lumber from which a permitted facility is to be constructed. If ammoniacal copper zinc arsenate (ACZA) treated piling or other project materials are proposed, the applicant will meet or exceed standards identified in the *Best Management Practices for the Use of Treated Wood in Aquatic Environments* developed by the Western Wood Preservers

Institute (1996), as well as any additional BMPs that may be required under the Hydraulic Project Approval issued by the WDFW.

7.11 Piles

The first piling shall be steel, 4-inch piling and at least 18 feet from the OHWL. After the first 18 feet, piling sets shall be spaced at least 18 feet apart. Piling shall not be greater than 12 inches in diameter. Piles shall not be treated with pentachlorophenol, creosote, CCA, or comparably toxic compounds. If ACZA piling are proposed, the permittee will meet all of the Best Management Practices, including a post-treatment procedure, as outlined in the amended Best Management Practices of the Western Wood Preservers.

7.12 Mooring Piles and Boatlift Piles

This permit allows for no more than 2 mooring piles driven per structure analyzed in this RBE. The 2-pile limit shall include all existing mooring piles. Moorage piling shall not be driven within 30 feet of the OWHL, shall not be placed any further waterward than the end of the existing pier, and shall not be placed more than 12 feet from any point on the pier. These piles shall be as far offshore as possible.

7.13 Floats, Piers, and Ramps

This RBE will authorize only one pier or float system, including an access ramp if necessary, contiguous to the shoreline, per upland private property ownership. This property must be adjacent to the navigable water. The following conditions apply:

All floats and ells must be 30 feet waterward of OHW. No Skirting is allowed on any structure.

a. Surface Coverage (includes all floats, ramps and ells):
- (1) Single property owner: 480 square feet
- (2) Two property owners (residential): 700 square feet
- (3) Three or more residential property owners: 1000 square feet.

b. Height above the water surface: except for floats, the bottom of all structures must be at least 1.5 feet above OHW.

c. Widths and lengths:
- (1) Piers- 4-foot wide and fully grated with at least 60% open area.
- (2) Ramps- must not exceed a width of 3 feet and must be fully grated.
- (3) Ells- must be in water with depths of 9 feet or greater at the landward end of the ell:
  - a. Up to 6-foot wide by 20-foot long with a 2-foot strip of grating down the center.

b. Up to 6-foot wide by 26-foot long with grating providing 60% open area over the entire ell.

(4) Floats- must be in water with depths of 10 feet or more at the landward end of the float. Floats can be up to 6 feet wide and 20 feet long, but must contain a minimum of 2 feet of grating down the center.

- Only one non-commercial, residential moorage facility per upland residential waterfront property owner or one joint-use moorage facility for two or more adjacent waterfront property owners is authorized.
- Any existing in-water and overwater structures within 30 feet of the OHWL, except for those facilitating access as authorized by this permit, shall be removed and no additional overwater structures shall be constructed in this nearshore area over the entire length of the property.
- The length of a pier is limited by the maximum square footage allowed (see items above). Any proposed pier that extends further waterward than adjacent piers will be reviewed on a case-by-case basis to assess impacts on navigation. This permit does not authorize piers determined by the Corps to have an adverse effect on navigation.
- Floats shall be designed so as to contain the flotation material under all conditions.
- All affected joint-use property owners must sign a legal agreement to construct a joint-use pier or install floats.

7.14 Navigation and Access to Adjacent Structures and Property

The permitted activity must not interfere with the public right to free navigation on navigable waters of the United States, including ingress and egress to adjacent waterfront structures and property.

Section 8. Determination of Effects

8.1 Puget Sound Chinook Salmon

The proposed actions “May Affect, but are Not Likely to Adversely Affect” chinook salmon. The proposed actions may result in temporary increases in suspended sediment during construction and future use; however, turbidity is expected to be temporary and short term. The required enhancement of shoreline riparian areas will improve existing riparian conditions. New structures will be designed and constructed to minimize shading to nearshore areas, minimize impacts to littoral habitats, and provide little cover to predatory fish. In-water work windows will minimize the chance that juveniles are present during project construction. New structures will not be permitted within 100 feet of tributaries to Lake Washington, Lake Sammamish, the Sammamish River, Lake Union, or the Lake Washington Ship Canal that may provide potential chinook salmon spawning habitat. Conservation measures are intended to improve or maintain the environmental baseline.

8.2 Coastal/Puget Sound Bull Trout

The proposed actions “May Affect, but are Not Likely to Adversely Affect” bull trout. Bull trout populations within the action area are very small and predominantly restricted to the Chester Morse Reservoir on the Cedar River, although bull trout/Dolly Varden have been documented in Lake Washington and Issaquah Creek (WDFW 1998). The proposed actions may result in temporary increases in suspended sediment during construction and future use; however, turbidity is expected to be temporary and short term. The required enhancement of shoreline riparian areas will improve existing riparian conditions. New structures will be designed and constructed to minimize shading to nearshore areas, minimize impacts to littoral habitats, and provide little cover to predatory fish. In-water work windows will minimize the chance that juveniles are present during project construction. New structures will not be permitted within 100 feet of tributaries to Lake Washington, Lake Sammamish, the Sammamish River, Lake Union, or the Lake Washington Ship Canal that may provide potential bull trout habitat. Conservation measures are intended to improve or maintain the environmental baseline.

8.3 Bald Eagle

The proposed actions “May Affect, but are Not Likely to Adversely Affect” bald eagles. The project will result in increased noise during construction activities. Construction adjacent to nesting or foraging areas will be seasonally restricted through the appropriate work windows. Eagles occur in the action area; however, they are likely acclimated to the elevated noise levels and human activity associated with the action area and the recreational opportunities it affords. The critical time period for wintering bald eagle foraging is October 31 to March 31. Under in-water timing restrictions for fish species, work will not occur during this critical time. Thus, the proposed actions will not affect wintering bald eagle foraging in the area. Timing restrictions for actions that occur within 1 mile of an active bald eagle nest site will also avoid potential impacts to nesting bald eagles. The bald eagle nesting season is from January 1 through August 15.

8.4 Marbled Murrelet

The RBE will cover activities that occur only in freshwater areas of Lake Washington, Lake Sammamish, the Sammamish River, Lake Union, and the Lake Washington Ship Canal. Activities covered under the RBE will not occur in any marine waters where foraging marbled murrelets may occur. Therefore, the activities proposed for coverage under the RBE will have "No Effect" to marbled murrelets or their designated critical habitat.

Section 9. Essential Fish Habitat

9.1 Background

Public Law 104-297, the Sustainable Fisheries Act of 1996, amended the Magnuson-Stevens Fishery Conservation and Management Act to establish new requirements for Essential Fish Habitat (EFH) descriptions in federal fishery management plans and to require federal agencies to consult with NOAA Fisheries on activities that may adversely affect EFH.

The Magnuson-Stevens Act requires all fishery management councils to amend their fishery management plans to describe and identify EFH for each managed fishery. The Pacific Fishery Management Council (1999) has issued such an amendment in the form of Amendment 14 to the Pacific Coast Salmon Plan, and this amendment covers EFH for all fisheries under NOAA Fisheries jurisdiction that would potentially be affected by the proposed action. Specifically, these are the chinook, coho and pink salmon fisheries. EFH includes all streams, lakes, ponds, wetlands, and other currently viable water bodies and most of the habitat historically accessible to salmon. Activities occurring above impassable barriers that are likely to adversely affect EFH below impassable barriers are subject to the consultation provisions of the Magnuson-Stevens Act.

The Magnuson-Stevens Act requires consultation for all federal agency actions that may adversely affect EFH. EFH consultation with NOAA Fisheries is required by federal agencies undertaking, permitting, or funding activities that may adversely affect EFH, regardless of its location. Under Section 305(b)(4) of the Magnuson-Stevens Act, NOAA Fisheries is required to provide EFH conservation and enhancement recommendations to federal and state agencies for actions that adversely affect EFH. Wherever possible, NOAA Fisheries utilizes existing interagency coordination processes to fulfill EFH consultations with federal agencies. For the proposed action, this goal is being met by incorporating EFH consultation to the ESA Section 7 consultation, as represented by this BE.

9.2 Location

The locations of activities covered by this BE have been described in detail previously (see Section 2.3 of this document). The RBE is intended to cover the specified activities in Lake Washington, Lake Sammamish, the Sammamish River and Lake Union, including the Lake Washington Ship Canal.

9.3 Description of Proposed Activities

The activities covered by this assessment have been described in detail previously (see Section 2.2 of this document). Projects to be analyzed under this RBE include:

- Construction of one new residential overwater structure or expansion of an existing residential overwater structure per waterfront property owner, <u>or</u> construction of one joint-use residential overwater structure per two or more waterfront property owners,

- Driving of moorage piling,

- Removal of an existing residential overwater structure,

- Future maintenance of a residential overwater structure, and

- Beach nourishment that may be required as part of the terms and conditions of an HPA issued by the WDFW.

Residential overwater structures may include the following combinations: (a) pier, ramp, and float; (b) ramp and pier; (c) ramp and float; or (d) float. A repaired or modified structure may be different in kind from the existing structure. For example, an existing float may be modified to a pier, ramp, and float. This permit will authorize the installation, replacement, repair, or modification of one overwater structure per residential waterfront property owner, <u>or</u> one joint-use overwater structure for two or more adjacent waterfront property owners. The proposed project must comply with the conservation measure and construction specifications detailed in Section 7 of this report.

9.4 Potential Adverse Effects of the Proposed Action

The potential effects of the proposed action are discussed in detail in Section 5 of this document. The Pacific salmon management unit includes chinook, coho, and pink salmon. Only chinook and coho salmon habitats are located within the action area. No groundfish or coastal pelagic species are found within the action area.

The proposed actions may result in temporary increases in suspended sediment during construction and future use; however, turbidity is expected to be temporary and short term. The required enhancement of shoreline riparian areas will improve existing riparian conditions. New structures will be designed to minimize shading to nearshore areas, minimize impacts to littoral habitats, and provide little cover to predatory fish. In-water work windows will minimize the change that juveniles are present during project construction. New structures will not be permitted within 100 feet of tributaries to Lake Washington, Lake Sammamish, the Sammamish River, Lake Union, or the Lake Washington Ship Canal that may provide potential salmonid spawning habitat. Incorporation of conservation measures required by the RBE will generally improve or maintain habitat conditions (see Section 7 Conservation Measures of this document).

9.5 Conservation Measures

Conservation measures are included for all actions covered under this RBE as detailed in Section 7 of this report. Conservation measures will generally maintain or lead to the improvement of habitat, including EFH, in the action area.

9.6 Conclusions

In accordance with the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act, the Corps has determined that the proposal would not adversely impact EFH utilized by Pacific salmon species. It has been determined that the proposed action will not adversely affect EFH for federally managed fisheries in Washington waters.

Section 10. References

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Appendix A

Application and Reference Biological Evaluation Form

US Army Corps of Engineers

Application and Reference Biological Evaluation Form

For Construction of New or Expansion of Existing Residential Overwater Structures and Drive Moorage Piling in Lake Washington, Lake Sammamish, the Sammamish River and Lake Union, Including the Lake Washington Ship Canal, in the State of Washington

1. **Referenced Biological Evaluation:**
   Biological Evaluation for Construction of New or Expansion of Existing Residential Overwater Structures and Drive Moorage Piling in Lake Washington, Lake Sammamish, the Sammamish River and Lake Union, Including the Lake Washington Ship Canal, in the State of Washington April 7, 2004. Regulatory Branch, Seattle District Corps of Engineers.

2. **Date**: ______________________________

3. **Applicant**: __________________________________ **Corps Reference No.**: __________________________
   Address: ____
   City: _______________________________________State: _____________ Zip: _____________________

4. **Agent:** ____
   Address: ____
   City: _______________________________________State: _____________ Zip: _____________________

5. **Location(s) of Activity:**
   Quarter Section: ____________ Section: ____________ Township: ____________ Range: ____________
   Latitude: _______________________________ Longitude: _______________________________________
   Street address: ____
   Waterbody: __________________________________ County: __________________________________

6. **Use type:** ☐ Private non-commercial ☐ Private Joint-use[1] non-commercial
   Name and address of joint-use property owner(s):
   ____
   ____

7. **Project description:**
   a. Length and width of pier: ____
   b. Length and width of ramp: ____
   c. Will the ramp be permanent or removable/seasonal:_____________________________________
   d. Length and width of float(s): ____
   e. Number of floats to be installed: ____
   f. If ells or finger piers to be installed, what is the distance from the Ordinary High Water Line (OHWL):______
   g. Length and width of grating to be installed:____

[1] Joint use requires at least two contiguous residential waterfront property owners.

h. Number of Moorage Piling to be installed: ____

i. Size of structure(s) to be removed (if applicable):____

j. Describe the amount (cubic yards), type/size, and location of material to be placed for beach nourishment or fish habitat enhancement, if authorized by an HPA issued by the Washington Department of Fish and Wildlife:

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k. Describe the elevation of the pier in relation to the OHWL:____

l. Describe the type of construction material to be used for the decking, fascia boards, stringers, pile caps, and whalers. Describe the type of preservative or paint to be used: ____

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m. Describe the type of floatation to be used. Include the color and composition (e.g., high density polyethylene, etc.) of flotation parts and materials that will contact the water: ___________________________________

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n. Provide the number, dimensions, and material of the piling to be installed to secure the pier, ramp, and/or float:

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o. Describe the type of floatation to be used. Include the color and composition (e.g., high density polyethylene, etc.) of flotation parts and materials that will contact the water: ___________________________________

p. Describe moorage piling, if applicable (i.e. number to be installed, distance from shore, material, etc:_____

____

q. Provide the minimum spacing between piling on any side of the structure's components (e.g., on the pier, ramp, and float): ____

____

r. Provide the depth of water under the landward edge of the float: ______________________________________

8. **Construction techniques:**

a. Describe how the piling will be installed. Include the type of equipment, tools, and machinery to be used:

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b. Describe how the pier, ramp, and float will be constructed, transported, and installed. Include the type of equipment, tools, and machinery to be used: ____

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c. The number of days it will take to complete the project: ____

d. Describe the methods proposed to prevent construction debris from entering the water or causing water quality degradation: ____

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9. **Description of the project area:**

a. Describe the length of the property shoreline along the OHWL, the slope of the shoreline landward from the OHWL, and the type of substrate on the shoreline landward of the OHWL: ____________________________

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b. Describe the vegetation along the shoreline above the OHWL. Include the number of trees and shrubs, the species, the height, and location. (Photos and/or drawings are recommended): ___________________________

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c. Describe the substrate waterward of the OHWL. Include the type of aquatic vegetation within a 200-foot radius of the proposed pier, ramp, and float, and the density of the vegetative cover (e.g., 75% vegetative cover and 25% unvegetated exposed substrate): ____

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d. Describe any existing or proposed in-water or overwater structures within 400 feet of this proposed pier, ramp, and float. Include the distance between these structures and this proposed pier, ramp, and float: ____________

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e. Describe the amount of large and small woody debris on the shoreline both above and below the OHWL. Include woody debris on adjacent property shorelines: ____

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10. **Conservation Measures to be implemented** (Check only the measures you will implement, leaving blank any measures you will not implement. State "not applicable" next to items that do not pertain to your project. For example, if no heavy equipment will be used during construction, write "not applicable" or "N/A" next to items a, b, and d):

a. ☐ All heavy equipment will be clean and free of external oil, fuel, or other potential pollutants.

b. ☐ Native riparian vegetation will not be removed or destroyed during project construction.

c. ☐ No overwater structure will be constructed within 100 feet of a wetland or the mouth of any river, stream, or creek.

d. ☐ Heavy equipment will work from on-shore staging areas and will not enter the water, with the exception of an excavator arm or bucket. Pile drivers may use constructed work platforms to access construction locations (i.e., a barge).

e. ☐ Placement of inwater fill material for the purpose of beach nourishment and/or fish habitat enhancement may occur, if required as a condition of the Hydraulic Project Approval issued by the Washington Department of Fish and Wildlife.

f. ☐ First piling will be 4-inch steel and at least 18 feet from OHW. Remaining pilings will be spaced at least 18 feet apart. Steel piling will be installed in accordance with sound attenuation measures described on the Corps website: *http://www.nws.usace.army.mil/reg.html*.

g. ☐ Grating will be installed to allow ambient light to penetrate the structure.

h. ☐ Installation and construction of permanent dock components will occur during approved inwater work windows for the protection of salmonids. Pile driving activities will also occur during approved work windows for the protection of bald eagles (Please refer to http://www.nws.usace.army.mil/reg/reg.htm for current in-water work windows.)

i. ☐ Removable/seasonal ramps must be removed annually from January 1 to June 29.

j. ☐ Total deck area waterward of the OHWL, including ramp structures, shall not exceed 480 square feet for individual overwater structures, 700 square feet for joint use structures with two adjacent property owners, or 1,000 square feet for joint use structures with three or more adjacent property owners. Two floats may be used for joint-use docks. Joint use requires at least two separate, but adjacent, property owners as applicants for the Corps of Engineers permit.

k. ☐ Piers and floats do not extend waterward of adjacent piers, ramps, and floats, and shall not adversely affect navigation.

l. ☐ No skirting will be placed on floats.

m. ☐ The dock shall be built with materials that do not leach preservatives or other compounds that are known to be deleterious to fishes (i.e. Pentachlorophenol, creosote, or Chromated Copper Arsenate (CCA), copper naphthalene, or other leachable protective chemicals).

n. ☐ Piers and ramps will be less than 4 feet wide.

o. ☐ The pier and ramp will be elevated at least 1.5 feet above the elevation of the OHWL.

p. ☐ No existing habitat features will be removed from the shore or aquatic environment (woody debris or substrate materials). If invasive weeds (e.g., milfoil) are present, removal may occur with authorization from the Washington State Department of Fish and Wildlife.

q. ☐ Shoreline armoring (e.g., bulkheads, rip rap, and retaining walls) will not occur in association with the pier, ramp, and/or float installation (before, during, or after installation of the pier, ramp, and/or float).

r. ☐ Riparian vegetation will be left intact during and following dock installation, except in the exact footprint of individual piling.

s. ☐ If absent, a 10-foot wide buffer of riparian vegetation shall be established along the length of the property shoreline. A pathway less than six feet wide is allowed to access the pier.

t. ☐ The applicant must, upon completion of construction, submit as-built photographs of the project. The Corps must inspect the pier, ramp and float, as well as the riparian buffer each year until completion of the monitoring period to ensure compliance with all permit conditions. During the inspections, the Corps will record any unanticipated indirect and cumulative effects.

11. **List those Conservation Measures that will not be met by this project. Describe why they won't be met:**

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12. **Justification of why the project constitutes a "not likely to adversely affect" determination without meeting all the Conservation Measures. For example, what conservation measures will be incorporated in addition to those listed in item 10? (Ask your consultant or Corps project manager for assistance, if needed.)**

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13. **Essential Fish Habitat, area affected (square footage of pier, ramp, and float):** ________________________

14. **Drawings:** Attach a vicinity map and project drawings (plan and elevation views required). Photographs are recommended.

15. **Planting plan:** Attach copy of planting, monitoring, and contingency plan for riparian area.

The following questions are to be completed by the Corps of Engineers

16. **Threatened or Endangered Species present (both listed and proposed). For federally-listed terrestrial and plant species, provide an addendum discussing potential impacts to those species.**

Species	Distance to Occurrence (i.e. to nest, perch tree)	Effect Determination (NE, NLTAA, or LTAA)

17. **Work window for construction:** ____________________ through ________________________________